REMARKS

In the Office Action mailed March 1, 2011, the Examiner withdrew the rejections of claims 1-4, 9-15 and 21-29 as presented in the Office Action of August 2, 2010.

The Examiner fully reconsidered claims 1-3, 6, 9, 11-15, and 21-29 and raised new objections and grounds of rejections in the present Final Office Action. Re-examination and reconsideration of this application, withdrawal of the objections and rejections, and a formal notice of the allowability of all claims as now presented are respectfully solicited in the light of the remarks as follows.

1. Withdrawal of claim 12

Claim 12, which is supported by section [0030], page 4, of the present published application is withdrawn. All objections regarding this claim as mentioned in the Final Office Action are therefore rendered moot (see present Final Office Action, from page 2, remark 4 to page 3, remark 7).

2. Obviousness

2.1. Claims 1-3, 6, 9, 11, and 21

Claims 1-3, 6, 9, 11, and 21 are rejected under 35 USC 103(a) as being unpatentable over Spitler et al.

Applicants respectfully request reconsideration and withdrawal of this rejection in the light of the argument below.

Spitler et al. discloses a novel manner of using organic dyes to sensitize polycrystalline photoelectrochemical cells with efficiencies that can exceed those of transition metal complexes, which are attached to the semiconductor solid substrates through at least two linkage functions (see from column 2, line 66 to column 3, line 4; and column 12, claim 1). Spitler et al. teaches to

use such dyes in their aggregated form and in combination with other dyes to extend the spectral range of absorption of the photoelectrochemical solar cell. The extent of aggregation is controlled by the structure of the functional attachment linkage on the dye (see column 7, lines 28 to 33). As described by Spitler et al., organic dyes can be effective at absorbing light and injecting electrons into a solid substrate when attached to the solid with carboxyl or phosphonic acid functions (see column 2, lines 20 to 23; and column 10, Example 7, lines 37 to 60).

Since Spitler et al. concerns a combination of dye used in aggregated form, the Examiner construed the first dye as a compacting compound of the present invention as claimed in present claim 1 and the "more than one dye" in Spitler et al. as the "photosensitizing dye" co-adsorbed with the compacting compound of the present invention.

Although organic dyes in Spitler et al. share some similarities with the compacting compound of the present invention by their binding properties to the semiconductor solid substrate, they do not share the same function and they do not work as a compacting compound in the meaning of the present invention, wherein the colourless compacting compound cannot absorb light contrary to the organic dye of Spitler et al. The organic dyes of Spitler et al. cannot therefore be construed to read on the compacting compound of the present invention. In Spitler et al., the organic dyes used under aggregated form and in combination with other dyes contribute to extend the spectral range of absorption, which implicitly involves said organic dyes being electron donating species. Furthermore the structure of the attaching linkage influences the spectrum of the dye layer on the solid surface (see Spitler et al., column 7, lines 58 to 64). Actually, compacting compounds of the present invention as claimed in claim 1 form with sensitizing dye a self-assembled compact mixed monolayer on the semiconductor metal oxide layer. Said compacting compounds protect the dye layer and the anode surface from electrolyte

components, in particular triiodide and water, by preventing free space or bare zones between dye molecules on said metal oxide surface (see present published application US 2008/0006322, page 2, sections [0015]-[0022]; from page 7, Example 4 to page 8, Example 6, sections [0081]; Wang et al. (scientific publication further submitted as support) J. Phys. Chem. B. 2003, p. 14336, right column, first paragraph, lines 4 to 17). Moreover, data relative to a solar cell comprising HDMA only and no dye (Z-907) shows that said solar cell has an efficiency of 0.2% under full sunlight intensity, which is insignificant compared to the efficiencies of the exemplified solar cells of the present invention comprising the dye alone or with the compacting compound (HDMA) (see data "Example: Fabrication of solar cells comprising HDMA," second paragraph, lines 6 to 10, and present published application US 2008/0006322, page 7, section [0068], Table 2). These data support the fact that compacting compounds of the invention are not dyes and, even more, not dyes in the meaning of Spitler et al. In addition, compacting compounds of the present invention as claimed in claim 1 cannot be organic dyes used under aggregated form in the meaning of Spitler et al., since the compacting compounds of the present invention have no "at least two attachment functions" allowing said aggregation.

Furthermore, Spitler et al. concerns the objective of obtaining efficient organic spectral sensitizers for dye-sensitized solar cells that have a significantly greater light harvesting ability than transition metal ruthenium complexes (see Spitler et al., column 2, lines 57 to 60). Knowing that the objective of the present invention is to increase the thermostability of dye-sensitized solar cells, the ordinarily skilled man could obviously not think that the teaching of Spitler et al. would help him find a solution such as claimed in claim 1 of the present application. Hence, presently amended claim 1 cannot be considered to be obvious over Spitler et al.

Claims 2, 3, 6, 11 and 21 depend from claim 1, which describes a regenerative

photoelectrochemical cell comprising specific compacting compounds having a structure of formula (1) or (2) and which is also considered to be non-obvious over Spitler et al., recite specific embodiments of the photoelectrochemical cells of the present invention. Therefore, claims 2, 3, 6, 11 and 21 are considered to be ipso facto non-obvious over Spitler et al.

2.2. Claim 12

Since claim 12 is withdrawn, the rejection based on obviousness over Spitler et al. and further in view of Ikeda et al., such as mentioned in the remark 11 of the present Final Office Action, is now moot.

2.3. Claims 13 to 15

Claims 13 to 15 are rejected under 35 USC 103(a) as being unpatentable over Spitler et al. in view of Sigma-Aldrich.

Applicants respectfully request reconsideration and withdrawal of this rejection in the light of the argument below.

Sigma-Aldrich discloses a specific organometallic dye that may be used as a photosensitizing dye in a regenerative photoelectrochemical cell, such as described in the present application.

Claims 13 to 15 concern specific embodiments of the photoelectrochemical cell of the present invention as claimed in claim 1, which is considered to be non-obvious over Spitler et al.

However, since no compacting compound selected from formula (1) or (2) nor a regenerative photelectrochemical cell comprising such a compacting compound are mentioned or taught by Spitler et al. or by Sigma-Aldrich, claims 13 to 15 are not considered to be obvious over Spitler et al. alone or, in view of Sigma-Aldrich. Therefore, these claims are not obvious over Spitler et al. alone or in view of Sigma-Aldrich.

It also has to be considered that Sigma-Aldrich should not be considered as a prior art to the present invention. This art considered by the Examiner, which is from the version 3.2 of Sigma-Aldrich catalog revised in April 4, 2009, and printed in July 22, 2010, is dated after the priority and filing dates associated with the present invention. Moreover, the specific organometallic dye disclosed in the July 22, 2010, version of Sigma-Aldrich is not disclosed, described or available in the previous catalog of Sigma-Aldrich of 2005.

2.4. Claims 21 to 27

Claims 21 to 27 are rejected under 35 USC 103(a) as being unpatentable over Spitler et al. in view of Chittibabu et al., which teach how to interconnect nanoparticles at low temperatures with compounds that have the ability to donate electrons to the sensitising dye and improving charge transfer from the sensitizing dye to the semiconductor oxide nanoparticle material (see Chittibabu et al., page 13, section [0095]).

Claims 21 to 27 recites specific embodiments of the regenerative photoelectrochemical cell of the present invention as claimed in claim 1, which concern specific components of the electrolyte such as redox system, room temperature molten salt, polar organic solvent, a compound as additive formed by a neutral molecule, and gelifying compound.

As demonstrated in the Applicants' reply to the Office Action of August 2, 2010, Chittibabu et al. does not disclose or concern a regenerative photoelectrochemical cell of the invention of claim 1, comprising a compacting compound within the meaning of the present invention.

Although Chittibabu et al. discloses components of the electrolyte similar to the components of the above-mentioned components that are the subject-matter of claims 21 to 27, there is no incentive to apply a method of interconnecting metal oxide nanoparticles for the

fabrication of thin film solar cells at low temperatures as taught by Chittibabu et al. to a method of using organic dyes under aggregated form to broaden the light harvesting spectrum and to improve the efficiency of photoelectrochemical cell as described by Spitler et al. to obtain a regenerative photoelectrochemical cell of the present invention as claimed in claim 1 with compacting compounds, wherein the dye layer and the anode surface are protected from the electrolyte components to improve the thermostability of photoelectrochemical cells.

Accordingly, it would not have been obvious at the time of the invention for an ordinarily skilled person to adapt the method of Spitler et al. in the light of Chittibabu et al. to achieve the photoelectrochemical cell of the invention as claimed in claim 1.

Since claims 21 to 27 depend on claim 1, which is considered to be non-obvious over Spitler et al. in view of Chittibabu et al., claims 21 to 27 are considered ipso facto non-obvious, as well.

Applicants respectfully request the reconsideration and withdrawal of this rejection in the light of the argument above.

2.5. Claims 22

Claim 22 is rejected under 35 USC 103(a) as being unpatentable over Spitler et al. and in further in view of Chittibabu et al. and Green et al.

The subject-matter of claim 22 concerns the composition of the electrolyte of the regenerative photoelectrochemical cell as claimed in claim 1, namely a room temperature molten salt being liquid at least between standard room temperature and 80°C above said room temperature.

Since claim 22 depends on claim 1, which is non-obvious over Spitler et al. alone, or in view of Chittibabu et al. and Green et al., claim 22 is also considered to be patentable over said

prior art.

Green et al. does not concern a photoelectrochemical cell, and even less a photoelectrochemical cell as claimed in claim 1, comprising compacting selected from formula (1) or (2). Moreover Green et al. does not teach how to improve the thermostability and the efficiency of a photoelectrochemical cell as does the present invention.

Accordingly, and from the above, there is no incentive to modify the teaching of Spitler et al. with the teaching of Chittibabu et al. combined with the teaching of Green et al. to provide the regenerative photoelectrochemical cell of the present invention.

As a result, claim 22 is regarded as being non-obvious over Spitler et al. in view of Chittibabu et al. and Green et al.

Applicants respectfully request the reconsideration and withdrawal of this rejection in the light of the argument above.

2.6. Claims 27 to 29

Claims 27 to 29 are rejected under 35 USC 103(a) as being unpatentable over Spitler et al. in view of Chittibabu et al. and Misra et al., which teach methods of fabricating microelectronic electrochemical cells comprising an architecture of a crossbar array structure. Misra et al. teaches to avoid damage and destruction of molecules in said crossbar array structure during the deposition and patterning of the second set of metal lines during the fabrication of said structure (see page 1, sections [0005] to [0007])

Claims 27 to 29 recite specific embodiments of the regenerative photoelectrochemical cell of the present invention as claimed in claim 1, namely specific technical features of the electrolyte comprising an effective amount of gelifying compound.

From the above, it must be concluded there is no motivation to combine the teaching of Misra et al., a method of fabrication of a crossbar array structure with the method of interconnecting metal oxide nanoparticles for the fabrication of thin film solar cells as taught by Chittibabu et al., with the teaching of Spitler at al., namely a method of using organic dyes under aggregated form to broaden the light harvesting spectrum and to improve the efficiency of photoelectrochemical cell, to provide the photoelectrochemical cell of the invention as claimed in claim 1.

Accordingly, it would not have been obvious at the time of the invention for an ordinarily skilled person to modify the method of Spitler et al. in the light of Chittibabu et al. and Misra et al. to realize the regenerative photoelectrochemical cell of the present invention to provide a more effective insulating barrier for the back electron transfer from TiO_2 conduction band to triiodide in the electrolyte, and to reduce dark current and increase the open circuit voltage of the solar cell.

Claims 28 and 29 depend on claim 27, which depends on claim 1, which is non-obvious. Thus claims 27 to 29 are considered ipso facto non-obvious over Spitler et al. in view of Chittibabu et al. and Misra et al.

4. <u>Conclusion</u>

For all these foregoing reasons, Applicants request entry of the withdrawal of claim 12, reconsideration of the present application in light thereof and the foregoing remarks, and an allowance of all pending claims over all the prior art of record.

Respectfully Submitted,

By [signature]
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